

## Impregnated activated carbon for environmental protection

K.-D. Henning and S. Schäfer

CarboTech-Aktivkohlen GmbH, Franz-Fischer-Weg 61, D-45307 Essen, Germany



Impregnated activated carbons are carbonaceous adsorbents which have chemicals finely distributed on their internal surface. The impregnation optimizes the existing properties of the activated carbon giving a synergism between the chemicals and the carbon. This facilitates the cost-effective removal of certain impurities from gas streams which would be impossible otherwise. For environmental protection, various qualities of impregnated activated carbon are available and have been used for many years in the fields of gas purification, civil and military gas protection and catalysis.

**Keywords:** activated carbon; impregnated activated carbon; mercury; hydrogen sulfide; environmental protect

### Introduction

Activated carbon is the trade name for a carbonaceous adsorbent which is defined as follows<sup>1</sup>: Activated carbons are non-hazardous, processed, carbonaceous products, having a porous structure and a large internal surface area. These materials can adsorb a wide variety of substances, i.e. they are able to attract molecules to their internal surface, and are therefore called adsorbents. The volume of pores of the activated carbons is generally greater than 0.2 ml g<sup>-1</sup>. The internal surface area is generally greater than 400 m<sup>2</sup> g<sup>-1</sup>. The width of the pores ranges from 0.3 to several thousand nm.

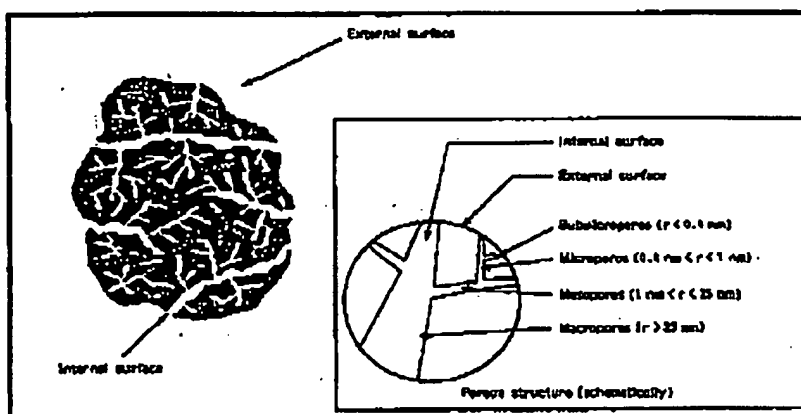


Figure 1: Schematic activated carbon model

All activated carbons are characterized by their ramified pore system within which various mesopores ( $r = 1-25$  nm), micropores ( $r = 0.4-1.0$  nm) and sub micropores ( $r < 0.4$  nm) branch off from what we call macropores ( $r > 25$  nm) (Figure 1). Activated carbons have been used for many years quite successfully for adsorptive removal of impurities from exhaust gas and waste water streams. However, for cost-effective removal of certain impurities contained in gases (such as hydrogen sulfide, mercury and ammonia), the adsorption capacities and the feasible removal rates must be substantially boosted by impregnation of the activated carbon by suitable chemicals. When these chemicals are deposited on the internal surface of the activated carbon, the removal mechanism also changes. The impurities are no longer removed by adsorption but by chemisorption.

Three reasons for impregnating activated carbon may be defined, and relevant examples are given below.

#### 1 Optimization of existing properties of activated carbon

Activated carbons are capable of catalytic oxidation of organic and inorganic compounds. The property of oxidation catalyst can be boosted by, for example, impregnation with potassium iodide acting as promoter. Potassium iodide-impregnated activated carbons are, in fact, already used for catalytic hydrogen sulfide oxidation to elemental sulfur, as described later.